REMARKS

Upon entry of the proposed amendments, which is respectfully requested, Claims 1-40 will be pending in the application.

The Examiner has withdrawn Claim 27 from consideration.

Claim 1 is amended to recite "wherein the feed and atomization fluid are admixed in the mixing chamber and form a homogeneous spray having a fan-like shape which exits the outlet of the mixing chamber in an unobstructed way and in a direction substantially parallel to the symmetry axes of the central nozzles." Support can be found, for example, at page 11, lines 21-23; and Figure 3. Claim 1 is further amended to overcome the rejection under 35 U.S.C. § 112, second paragraph as described further below. No new matter is added.

Claim 16 is amended for clarification to recite "wherein the opening angle α varies between 5° and 90°, ~~α being a function of the number of atomization fluid nozzles~~."

New Claim 39 is added to recite "wherein for each central nozzle of atomization there are two feed side nozzles." Support can be found, for example, at page 10, first full paragraph and Fig. 2A.

New Claim 39 is added to recite "wherein the central nozzles are laterally juxtaposed." Support can be found, for example, in Figure 2B, as the nozzles are arranged in a linear fashion. This stems from the fact that the feed dispersion system presents a symmetry plan passing through the symmetry axes of all of the central nozzles. No new matter is added.

Entry of the Amendment along with reconsideration and review of the claims on the merits are respectfully requested.

Formal Matter

Applicants appreciate that the Examiner has approved the formal drawings filed October 7, 2004.

Election/Restriction

The Examiner states that newly submitted Claim 27 is independent or distinct from the invention originally claimed because Claim 27 is a method of atomizing a hydrocarbon feed which does not require the particulars of the apparatus claims.

Applicants respond as follows.

Applicants respectfully request clarification as to the status of Claim 27, as Claim 27 was included in the rejection under 35 U.S.C. § 102(e) at paragraph 6 of the Office Action, apparently in error. If Claim 27 is withdrawn, Applicants respectfully request rejoinder of the method claim upon issuance of the product claims, recognizing that the method claim must be consistent with the limitations of the product claim.

Response to the Claim Rejection Under 35 U.S.C. § 112

Claims 1-26 and 28-38 are rejected under 35 U.S.C. §112, second paragraph, as assertedly being indefinite.

Applicants respond as follows.

The Examiner states that where Claim 1 recites the limitation "the discharge zones" in line 17 of the claim, there is insufficient antecedent basis for this limitation *in the claim.*

Applicants respond by incorporating the Examiner's suggestion to delete the word "the" in order to overcome this aspect of the rejection.

The Examiner states that Claim 1 recites a mixing chamber in line 11 of the claim, and then again recites "a mixing chamber" in line 17 of the claim. The Examiner suggests that since only one mixing chamber is disclosed in the apparatus, Claim 1 should also be amended to state "the mixing chamber" at line 17. Applicants respond by incorporating the Examiner's suggestion in order to overcome this aspect of the rejection.

The Examiner states that where Claim 16 recites that the angle α is a function of the number of nozzles, it is unclear what defines α, as such a function or relationship has not been defined in the specification. The Examiner states that since a relationship has only been stated as existing and not defined, the scope of this claim cannot be determined. Applicants note that Claim 16 has been amended to remove the phrase "α being a function of the number of atomization fluid nozzles" for clarification, and respond by pointing to support in the specification, for example, at page 12, lines 1-11, specifically lines 3-4, which clearly defines the angle α as "the opening angle of the mixing chamber, as measured in the direction of the sequence of atomization fluid nozzles (110)" (see also Figure 3).

As explained in the specification, the number of nozzles, the overall surface area at the bottom and at the top of the mixing chamber 101, as well as the depth of the mixing chamber, are adjusted so as to create an angle α in the range between 5° and 90°, preferably 10° and 60°, in order to promote the efficient contact between the catalyst and the atomized feed in an FCC process.

Claims 1-26 and 28-38 are definite and satisfy the requirements of 35 U.S.C. §112, second paragraph. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, second paragraph.

Response to the Claim Rejection Under 35 U.S.C. § 102

Claims 1-15, 17-19, 23, 27-33 and 38 are rejected under 35 U.S.C. §102(e) as assertedly being anticipated by Newton (US 6,088,934).

Applicants submit that this rejection should be withdrawn because Newton does not disclose or suggest the feed dispersion system for FCC units of the present invention.

As previously stated, Applicants amend Claim 1 to recite "wherein the feed and atomization fluid are admixed in the mixing chamber and form a homogeneous spray having a fan-like shape which exits the outlet of the mixing chamber in an unobstructed way and in a direction substantially parallel to the symmetry axes of the central nozzles." Support can be found, for example, at page 11, lines 21-23; and in Figure 3.

Regarding Newton, the promotion of the monomer and fluidizing gas contact in Newton is carried out by means of an axial nozzle to generate an increased energy jet while the liquid feed attains said energy jet through orifices. These are the only similarities between Newton and the present application. This is because in the present application, the outlet of the atomization fluid jet continues along the symmetry axis of atomization fluid nozzle 110 into the reactor, without the presence of a cap, as in Newton.

More particularly, Newton's disclosure includes a cap (not numbered) having at least one outlet (elements 5 and 6 in Figure 2 below) so that the energy received by the liquid feed at the bottom of mixing chamber 4 directs the feed against the upper wall of the cap, thus promoting the coalescence of the drops generated by the initial contact of the atomization fluid and the liquid feed at the bottom of chamber 4. In other words, Newton's cap directly obstructs the outlet of the liquid feed from the mixing chamber.

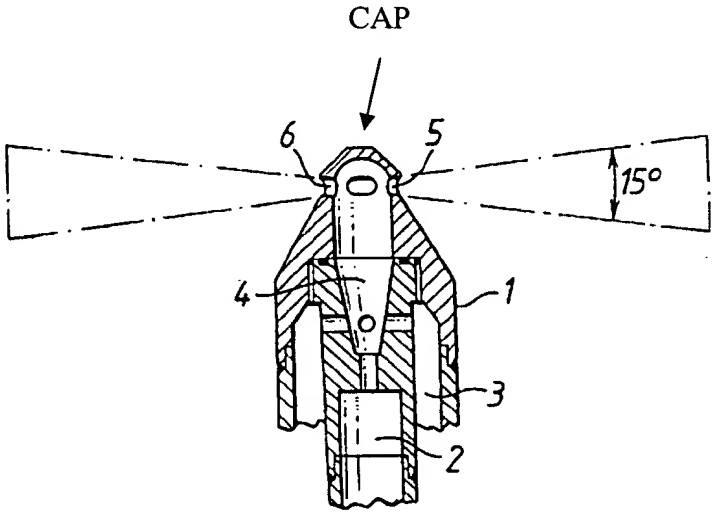

FIG. 2

Newton's Claim 1 requires that the device comprise at least one outlet, and Figure 2 of Newton shows that at least one outlet is arranged circumferentially around said nozzle. Newton describes that, "the horizontal penetration of liquid into the fluidized bed at each outlet is in the range of 250 to 2500 mm" (column 4, lines 10-15), said penetration being directed to a horizontal dispersion in a polymerization process. The physical structure of Newton's nozzle shows that nearly all of the atomization energy created between the atomization fluid and the

feed at the bottom of chamber 4 is lost when the atomized fluid is directed against the cap of chamber 4. Then, the liquid and gas mixture is again atomized by passage through side outlets 5 and 6 where the atomization fluid is again accelerated to promote the horizontal penetration of the liquid and gas mixture, circumferentially around the axis of the atomizing nozzle.

In Newton the outlet of the feed and atomization fluid mixture is carried out perpendicular to the axis of the atomizing fluid nozzle. Newton aims at obtaining maximum dispersion in the catalytic bed, perpendicular to the axis of the atomizing fluid passage nozzle.

On the other hand, the outlet of the present invention does not show such an arrangement. The present invention does not use a cap, as mixing chamber 101 has an inverted truncated-pyramidal shape. Said shape is obtained, according to Figure 2B of the present application, by the lateral juxtaposition of inverted truncated-pyramidal volumes. As a consequence of the lateral juxtaposition of inverted truncated-pyramidal volumes, the atomized jet takes the shape of a divergent fan in the plane in the course of its separation from the bottom of the mixing chamber 101, and in the course of its exiting the outlet of the mixing chamber in an unobstructed way. This fan is represented, for example, in Figure 3. In this manner, no coalescence of droplets generated at the mixing chamber 101 bottom occurs by the contact between the liquid feed and the atomizing fluid with a cap. Further, the nozzles of the present invention are designed so as to concentrate the pressure drop of the liquid feed in the truncated-conical section and in the orifice that injects the liquid feed into the mixing chamber 101. Thus, the present invention is distinguishable from Newton's disclosure by at least the flow of the feed

and atomization fluid which exits the outlet of the mixing chamber in an unobstructed way and in a direction substantially parallel to the axes of the central nozzles.

As a further point of distinction, in Newton there is only one atomization fluid nozzle and two, four, six or eight liquid feed nozzles. Newton does not indicate if more than one atomization fluid nozzle is encompassed by the invention. It is not known how more than one atomization fluid nozzle in chamber 4 would be arranged.

On the other hand, in the present invention there are, for each atomization fluid nozzle, two liquid feed nozzles (see Claim 39 and Fig. 3). The atomization fluid nozzles 110 are laterally juxtaposed (see Claim 40). Also, the present invention provides for arrangements with several dispersion systems radially disposed in a riser FCC unit (see Claim 26). Such a kind of arrangement is not disclosed by Newton.

In view of the distinctions between Newton and the present invention discussed above, Applicants respectfully request reconsideration and withdrawal of the § 102(e) anticipation rejection of Claims 1-15, 17-19, 23, 27-33 and 38 based on Newton.

Response to the Claim Rejections Under 35 U.S.C. § 103

A. Claims 20-22, 24, 26 and 34-37 are rejected under 35 U.S.C. §103(a) as assertedly being unpatentable over Newton as applied above, and further in view of Williatte et al. (US 5,037,616), for the reasons given in the Office Action.

The Examiner recognizes that with respect to Claims 20, 21, 24 and 25, Newton only illustrates wherein the shape of the central and side nozzles are cylindrical and does not disclose a convergent/divergent (venturi) shape.

However, the Examiner cites Williatte as disclosing a nozzle for feed injection into an FCC reactor riser and teaching the use of a venturi in order to achieve atomization of the feed.

Applicants respectfully submit that the combination of Newton with Williatte fails to render obvious the present invention.

Claims 20-22, 24, 26 and 34-37 are patentable over Newton in view of Williate for at least the same reasons that Claims 1-15, 17-19, 23, 27-33 and 38 are patentable over Newton alone. Williatte does not make up for the deficiencies of Newton.

Further, Newton as well as the present application refer to devices provided with conduits and nozzles arranged so that an atomizing fluid and a liquid feed are admixed forming a mixture to be atomized so that the desired reaction is effected with the highest possible input or lower possible pressure drop.

However, the similarities between Newton and the present application are limited to only this broad aspect. Because Newton is directed to an olefin polymerization process where the monomer is to be dispersed in a catalytic bed, it can be said that Newton refers to a device aimed at promoting contact between an atomized mixture of monomer and fluidizing gas and catalyst particles in a fluid catalytic bed.[1] This is different from the present application, which refers to a

[1] Indeed it is questionable whether Newton is even in the same category of art as the present invention, as Newton relates to a nozzle system for polymerization reactions rather than for catalytic cracking. In order for the Examiner to rely on Newton as a basis for an obviousness rejection of ...(footnote continued)

device aimed at promoting contact between feed and catalyst in an upflow tubular reactor where the particles are displaced in a regimen of pneumatic transport flow, in the absence of any catalytic bed.

Structurally, the art employed in olefin polymerization is directed to nozzles aimed at promoting horizontal penetration of a liquid and gas mixture in a catalytic bed (Newton, column 4, lines 10-15), while, on the other hand, in an FCC process the focus is the atomization of a liquid and gas mixture within an upflow tubular reactor operating under a regimen of pneumatic transport flow. Thus, one of ordinary skill in fluid catalytic cracking units would *not* turn to the field of art of gas-phase polymerization of olefins.

In this regard, catalytic cracking reactions are *endothermic* while polymerization reactions of olefins are *exothermic*. In other words, the exothermic character of an olefin polymerization process in Newton is completely opposite to the endothermic character of the cracking reaction of a hydrocarbon mixture as in the present application. These different applications of a technique (or device) are related to different industrial processes.

Thus, a skilled artisan would not be motivated to apply Newton's teachings to the present invention, much less combine Newton with the secondary reference to Williatte.

Williatte makes the mixture of liquid feed and atomizing fluid in the interior of the convergent/divergent nozzle, being at the same time a mixing chamber and atomization promoting element. In Williatte's application, the two streams are independently generated and

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Applicants' invention, Newton must either be in the field of Applicants' endeavor or, if not, then be reasonably pertinent to the particular problem with which the invention was concerned. See MPEP § 2141.01(a).

the fluids are placed in the mixing chamber in an independent manner. In a venturi tube the throat presents the more intense flow conditions. In Williatte, since the flow in the throat is critical, the pressure drop at the beginning of the venturi section and at the outlet 7 is the same for both fluids, and of a high value (see also column 2, line 30, which describes that there is a mixing section before the venturi).

In Williatte, the mixing and the atomization chamber has the shape of a convergent/divergent nozzle. The two fluids are mixed axially to the atomizing nozzle axis. Upon being mixed, the fluids flow parallel to the axis of the atomizing nozzle. The fluids are mixed before passing at the inlet of the atomizing nozzle having a venturi profile. At the top there is a protecting cap 7 integral with the venturi discharging cone and which defines the shape of the outlet jet of the atomized mixture. Also in Williatte, the pressure drop of the liquid is the same as that of the atomizing fluid due to the mixing of the streams at the inlet and two-phase flow at the venturi throat.

In comparison, the present invention has several distinctions relative to Williatte's disclosure: i) independence in the mixture of the fluids; ii) mixing chamber 101 completely differs from the venturi of Williatte; iii) there is a juxtaposition of cells in an inverted truncated-pyramidal shape; and iv) there is no cap needed to promote the coalescence of the droplets generated by the passage of fluids through the throat of the venturi profile. Thus, the cap in Williatte would prevent a "homogeneous spray having a fan-like shape which exits the outlet of the mixing chamber in an unobstructed way" as in the present invention. A skilled artisan would not be motivated to combine the teachings of Williatte with Newton, and even if the

teachings of Williate and Newton are combined, such combination would still not achieve the present invention.

In effect, according to the present invention, independent nozzles that generate a high speed jet and the manner in which the feed and high energy atomization fluid are contacted promote the throttling of the high-energy jet so as to secure efficient energy conveyance from atomizing fluid to liquid feed, which in turn is instantaneously accelerated, thereby promoting intense atomization without further coalescing. The absence of coalescence is attributable to the inverted truncated-pyramidal shape of the cells depicted in Figure 2B of the present application. Such features are neither described or suggested in Newton alone or when combined with Williatte.

Furthermore, in Williatte the acceleration of the fluid is gradual and not instantaneous as in the present invention. The venturi device is the element used to promote the atomization.

In the present invention, the venturi is used to mix and promote the atomization of the previously mixed liquid feed and atomization fluid. Since independent nozzles promote mixture and atomization at the bottom of chamber 101, the feed can be at a much lower pressure than the atomization fluid. Thus, in the present application it is possible to obtain intense atomization at a lower pressure drop between the outlet of chamber 101 and the inlet of the atomization nozzle.

In conclusion, the physical structure of the present device, having independent nozzles for the passage of liquid feed and steam, is designed to obtain the maximum benefit from the atomization fluid energy without the need to impart high pressures to the liquid feed. This does not occur in Williatte's venturi since the two fluids are mixed at the inlet of the atomizing device.

And in Newton, as discussed, there is a cap. Also the mixture outlet in Newton is circumferential and perpendicular to the axis of the atomizing fluid nozzle; and chamber 4 is truncated-conical, which prevents the lateral juxtaposition as in the present invention.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a) over Newton in view of Williatte.

B. Claim 26 is rejected under 35 U.S.C. §103(a) as assertedly being unpatentable over Newton in view of Chen (US 6,387,247) and Steffens et al. (US 5,173,175), for the reasons given in the Office Action.

Applicants respectfully submit that the combination of Newton with the secondary references to Chen and Steffens does not render obvious the present invention.

Claim 26 is patentable over Newton in view of Chen and Steffens for the same reasons that Claim 1 is patentable over Newton alone. Chen and Steffens do not make up for the deficiencies of Newton.

Further, Chen teaches, as shown in Figure 1 of Chen, that the mixing zone of the liquid feed and atomization fluid is separated from the contact region of the spray and catalyst by a metal wall having passages for the spray. Such wall or obstacle would prevent the "homogeneous spray having a fan-like shape" as recited in the present invention.

Steffens merely teaches a conventionally known feed injector which discharges at an angle to the riser between 0° and 75°. Steffens fails to make up for Newton's deficiencies.

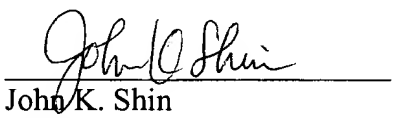
Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of Claim 26 under 35 U.S.C. § 103(a) over Newton in view of Chen and Steffens.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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